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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/534,217	05/06/2005	Kannan Ramanathan	NREL 02-29	1000

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EXAMINER

DIAMOND, ALAN D

ART UNIT	PAPER NUMBER
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1753

DATE MAILED: 04/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/534,217	Applicant(s) RAMANATHAN ET AL.	
	Examiner Alan Diamond	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on _____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 May 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>05062005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

In order to more clearly indicate Figures 6A through 6G in the brief description of the drawings, the term "FIG. 6 is a graph" at line 17 on page 4 should be changed to "FIGS. 6A through 6G are graphs". Then the term "shown in FIGS. 6A thru 6G" at line 18 on page 4 should be deleted.

Portions of the text on page 2 are blurred, perhaps due to photocopying. It is requested that all of the paragraphs on page 2 be resubmitted in an amendment to the specification.

On page 5, at line 22, and on page 7, at line 14, the term "dehydrate" should be changed to "dihydrate".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 is indefinite because the preamble recites "by doping from a vapor phase" (line 2), yet the process steps of the claim are silent concerning this doping. It is suggested that the term "to dope the Cu(inGa)Se₂ with Zn" be inserted at line 8 of claim

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1 after the word "compound" and before the semicolon. The same applies to dependent claims 2-17.

In claim 3, at line 2, it is not clear what is meant by the term "zinc acetate dehydrate". It is suggested that "dehydrate" in said term be changed to "dihydrate". See claim 4 and page 5, line 20, of the instant specification.

Each of claims 6 to 9 is indefinite because it is not clear when the substrate has the recited temperature, i.e., of about 100°C (claim 6), of about 150°C (claim 7), of about 200°C (claim 8), and between 200°C and 250°C (claim 9). It is suggested that "during said heating" be inserted immediately before the period and after the last °C at the end of each of claims 6 to 9. The same applies to dependent claims 10 to 17.

Each of claims 10 to 13 is indefinite because "said acetic acid" at line 1 in each of said claims lacks positive antecedent support in respective claims 6 to 9. The same applies to dependent claims 14 to 17.

Each of claims 10 to 13 is also indefinite because it is not clear where the acetic acid is used. See line 1 in each of said claims. The same applies to dependent claims 14 to 17.

Claim Rejections - 35 USC § 102/103

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 18 and 19 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Ramanathan et al (WO 99/17377).

Ramanathan et al prepares a thin film solar cell comprising a first layer of p-type CIGS, i.e., $\text{Cu}(\text{InGa})\text{Se}_2$, an n-type second layer from zinc chloride (instant zinc compound) that can be deposited by CVD or sublimation using zinc chloride as a vapor source; and the resulting zinc chloride is etched with hydrochloric acid then provided with sputter-deposited ZnO (see page 3, lines 17-29; page 4, lines 9-14; and page 5, line 16 through page 6, line 2). It is the Examiner's position that the solar cell prepared by Ramanathan et al is the same as here claimed, even though Ramanathan et al uses hydrochloric acid, rather than acetic acid, as the etchant in its process. With respect to claim 19, it is the Examiner's position that Ramanathan et al's solar cell prepared using zinc chloride is the same as the instant solar cell prepared using zinc acetate dihydrate after the etching. Since Ramanathan et al teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

In the event that any differences can be shown for the produce of the product-by-process claims 18 and 19, as opposed to the product taught by the reference Ramanathan et al, such differences would have been obvious to one of ordinary skill in

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the art as a routine modification of the product in the absence of a showing of unexpected results; see also In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

7. Claims 1-9, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramanathan et al (WO 99/17377).

With respect to claims 1-9, Ramanathan et al prepares a ZnO/CIGS solar cell without depositing a buffer layer and by Zn doping from a vapor phase, comprising: depositing the CIGS, i.e., Cu(InGa)Se₂ layer on a Mo back contact on a glass substrate, subjecting the CIGS layer to zinc chloride vapor to dope the CIGS layer; etching the deposited zinc material with hydrochloric acid; and then sputter depositing ZnO by well known procedure (see page 4, line 9 through page 6, line 2).

With respect to claims 18 and 19, Ramanathan et al prepares a thin film solar cell comprising a first layer of p-type CIGS, i.e., Cu(InGa)Se₂, an n-type second layer from zinc chloride (instant zinc compound) that can be deposited by CVD or sublimation using zinc chloride as a vapor source; and the resulting zinc chloride is etched with hydrochloric acid then provided with sputter-deposited ZnO (see page 3, lines 17-29; page 4, lines 9-14; and page 5, line 16 through page 6, line 2). It is the Examiner's position that the solar cell prepared by Ramanathan et al is the same as here claimed, even though Ramanathan et al uses hydrochloric acid, rather than acetic acid as the etchant in its process. With respect to claim 19, it is the Examiner's position that Ramanathan et al's solar cell prepared using zinc chloride is the same as the instant solar cell prepared using zinc acetate dihydrate after the etching.

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Ramanathan et al teaches the limitations of the instant claims, other than the difference which is discussed below.

With respect to claims 1-9, Ramanathan et al does not specifically teach heating its glass substrate to a temperature of 100 to 250°C before subjecting the CIGS layer to the zinc chloride vapor. However, zinc chloride vaporizes at 720°C. In order for the vaporized zinc chloride to condense onto the glass substrate, the substrate should be maintained at a temperature lower than said 720°C. A skilled artisan would have been motivated to use a temperature of, for example, 200°C so that the zinc chloride could diffuse into the CIGS film (see page 5, lines 22-24 of Ramanathan et al). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have set Ramanathan et al's glass substrate at a temperature of, for example, 200°C and then deposited the zinc chloride from vapor onto the substrate because zinc chloride vaporizes at 720°C, and thus, in order for the vaporized zinc chloride to condense onto the glass substrate, the substrate should be maintained at a temperature lower than said 720°C; and because a skilled artisan would have been motivated to use a glass substrate temperature of, for example, 200°C so that the zinc chloride could diffuse into the CIGS film.

8. Claims 10-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramanathan et al as applied to claims 1-9, 18, and 19 above, and further in view of Wright et al (U.S. Patent 4,687,725).

Ramanathan et al, as relied upon for the reasons recited above, teaches the limitations of instant claims 10-17, the difference being that Ramanathan et al does not

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specifically teach using acetic acid in place of hydrochloric acid, for its etching of the zinc material. Wright et al teach the interchangeability of using hydrochloric acid and acetic acid for etching zinc (see col. 9, lines 52-53). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used acetic acid in place of hydrochloric acid for Ramanathan et al's etchant because the substitution of art recognized equivalents, as shown by Wright et al, would have been within the level of ordinary skill in the art.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alan Diamond whose telephone number is 571-272-1338. The examiner can normally be reached on Monday through Friday, 5:30 a.m. to 2:00 p.m. ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Alan Diamond
Primary Examiner
Art Unit 1753

Alan Diamond
April 5, 2006

A handwritten signature in black ink, appearing to read 'Alan Diamond', with a long horizontal flourish extending to the right.